HMDSO / O_2 atmospheric pressure plasma chemistry leading to SiO_2 film synthesis

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The deposition with plasmas at atmospheric pressure is always challenging because of high collision rates, absence of ion bombardment, the filamentary behaviour of the plasma and the limited knowledge of the plasma chemistry. For example, inorganic, carbon free SiO_2 films can be deposited at atmospheric pressure, but with compromised film quality. To get a better insight into the plasma chemistry and the film growth processes leading to SiO_2 films, microplasma jets can be used.

Here we report on the deposition of SiO_2 film by means of microplasma jets driven by RF voltage and operated in Ar or He as plasma forming gas. Hexamethyldisiloxane (HMDSO) is used as precursor to generate SiO_2.

The geometry of the microplasma jet allows the application of several jets with different gas mixtures to one surface position to study surface reactions. Doing these experiments in a controlled atmosphere, the admixture of air can be avoided and growth mechanisms can be studied under defined gas admixtures of O_2, N_2 and/or H_2. In situ and ex situ FTIR and XPS measurements are performed to analyse the plasma chemistry and the film structure. Molecular beam mass-spectrometry is used to measure neutral species in the gas phase.

The simple design of the jet allows straightforward modelling of gas flow and afterglow plasma chemistry. The result of this model will be compared to the measurements.